

Soil Name	Soil* Perm.	Natural* Drainage	Subsurface Depth	Drainage Spacing	Recommen-dations*	Soil* Limits
ADAIR	4	B			2	a
AHOLT	4	A			1,4,5	a
ALBATON	4	A			1,3,4,5	a
ALSUP	3	C			8	c
ARBELA	3	B			1,4,6	
ARMSTRONG	4	B			2	a
ASHTON	2	C			8	
AUXVASSE	4	A			1,5	a
BADO	4	A			1,10	e
BARCO	2	C			8	c
BARDEN	4	C			6	a
BATES	2	C			8	c
BEAUCOUP	3	A			1,4,6	
BELKNAP	2	B	3-4	80-100	1,4,7	
BLACKOAR	2	A	3-4	90-110	1,4,7	
BLAKE	2	B	3-4	100-150	1,3,4,7	
BLENCOE	4	A	3.5-4	80-100	1,3,9	
BLOOMSDALE	2	C			1,4,8	a
BOLIVAR	2	C			8	c
BOOKER	4	A			1,4,5	a
BOSWORTH	4	A			1,4,5	a
BREMER	3	A	3-4	60-80	1,4,7	
BRITWATER	2	C			8	
BRONAUGH	2	C			8	d
CALWOODS	4	B			5	a
CAPTINA	4	C			10	e
CARLOW	4	A			1,4,5	a
CARR	1	C			4,8	
CARYTOWN	4	A			1,5	a,b
CEDARGAP	1	C			4,8	d
CHARITON	4	A			1,6	a
CHEQUEST	3	A			1,4,6	
CHEROKEE	4	B			1,5	a

*See opposite page for description.

DEFINITIONS

(See Introduction for further explanation)

Soil Permeability:

- 1 - Rapid or moderately rapid
- 2 - Moderate
- 3 - Moderately slow
- 4 - Slow or very slow

Natural Soil Drainage:

- A - Poor or very poor.
- B - Somewhat poor
- C - Well or moderately well
- D - Excessive or somewhat excessive

Drainage Recommendations

1. Land leveling or surface field ditches may be needed to improve surface drainage on nearly level slopes and on areas with small depressions.
2. Wetness is usually due to sidehill seepage. Use interceptor drains near the contact of the less permeable layer.
3. Adequate gravity outlets for subsurface drainage systems are rarely available. A pump station may be needed for an outlet.
4. Areas may be subject to occasional-to-frequent overflow. An onsite evaluation is needed to determine severity and frequency of overflow. Use diversions to intercept runoff from adjacent uplands. Dikes or levees may be needed along adjacent streams if flooding is severe.
5. Subsurface drainage systems are not practical because a slowly permeable layer is in the top 24 inches of the soil profile. Drain spacings less than 20 feet are required.
6. Subsurface drainage systems may be effective but drain spacings less than 60 feet are required.
7. Subsurface drainage is usually effective at depths and spacings indicated.
8. Surface and subsurface drainage is not normally beneficial.
9. Subsurface drainage may be beneficial to lower the seasonal high water table. Wide subsurface drain spacings are effective with adequate surface drainage.
10. Subsurface drainage is generally not practical to lower the seasonal high water table because of difficulty in installation into dense fragipan within top 36 inches of soil profile.

Soil Limitations

- a. A clayey subsoil layer with slow or very slow permeability restricts the downward movement of water within the root zone of most plants.
- b. Highly alkaline subsoil, which will greatly reduce crop production if exposed, may limit depth of cut during landgrading.
- c. Bedrock within the top 48 inches of the soil profile may interfere with grade and alignment of subsurface drains or conduits.
- d. Subsoil may contain sand. Unstable trenches may occur during installation of conduits. Perforated drains may need filters. If sand is shallow in soil profile, it may limit depth of cut during landgrading.
- e. Fragipan in top 30 inches of profile will limit root development of most crops.

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CLAIBORNE	2	C			8	
CLARINDA	4	A			2	a
CLEORA	1	C			4,8	d
COLAND	2	A	3-4	120-150	1,4,7	
COLLINSVILLE	2	C			8	c
COLO	2	A	3-4	80-100	1,4,7	
COTTER	2	C			8	
CRAIG	3	C			8	
CRELDON	4	C			10	e
CRIDER	2	C			8	
DARWIN	4	A			1,4,5	a
DEEPWATER	2	C			8	
DENNIS	4	C			6	a
DOCKERY	2	B	3-4	90-110	1,3,4,7	
DUPO	4	B			1,3,4,6	a
EDINA	4	A			1,3,6	a
ELK	2	C			8	
ELSAH	1	C			4,8	
ERAM	4	C			5	c
EUDORA	2	C			4,8	
FATIMA	2	C	3-4	90-110	1,4,7	
FORNEY	4	A			1,4,5	a
FOURCHE	3	C		8		
FREEBURG	3	B			1,4,6	
GATEWOOD	4	C			8	a,c
GERALD	4	B			1,10	e
GIFFORD	4	B			2	a
GILLIAM	2	B	3-4	90-110	1,7	
GLADDEN	2	C			4,8	
GLENSTED	4	A			5	a
GORHAM	3	B	3-4	120-150	1,4,7	
GORIN	4	B			8	a
GREENTON	4	B			6	a

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HAIG	4	A			1,6	a
HARTVILLE	4	B			1,4,6	a
HARTWELL	4	B			1,6	a
HATTON	4	C			5	a
HAYMOND	2	C			4,8	
HAYNIE	2	C			4,8	
HEPLER	2	B	3.5-4	60-70	1,4,7	
HIGGINSVILLE	4	B			2	a
HILDEBRECHT	4	C			10	e
HOBERG	4	C			10	e
HOBSON	4	C			10	e
HODGE	1	D			4,8	d
HUMESTON	4	A			1,5	a
HUNTINGTON	2	C			4,8	
IDA	2	C			8	
JONCA	4	C			10	e
JUDSON	2	C			8	
KARNAK	4	A			1,4,6	a
KEENO	4	C			10	e
KEG	2	C			4,8	
KENMOOR	1	C			3,4,8	d
KENNEBEC	2	C			4,8	
KENOMA	4	C			1,8	a
KESWICK	4	C			2	a
KICKAPOO	2	C			4,8	
KILWINNING	4	B			5	a
LADOGA	3	C			8	
LAGONDA	4	B			2	a
LAMONI	4	B			2	a
LANTON	3	A			1,4,6	
LEBANON	4	C			10	e
LEONARD	4	A			5	a

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LETA	4	B	3-4	80-100	1,4,9	a
LEVASY	4	A	3-4	80-100	1,4,9	
LIBERAL	4	C			5	a,c
LIGHTNING	4	B			1,4,5	a
LINDLEY	3	C			8	
LINEVILLE	4	B			6	a
LOMAX	1	C			8	
LOUGHBORO	4	A			1,6	a
LULA	2	C			8	
LUTON	4	A			1,3,4,5	a
MACEDONIA	2	C			8	
MACKSBURG	3	B	3-4	80-100	7	
MANDEVILLE	2	C			8	c
MARION	4	A			5	a
MARSHALL	2	C			8	
MARTIN	4	C			1,6	a
MAYES	4	B			1,5	a
MCGIRK	4	B			2	a
MCPAUL	2	C			4,8	
MELVIN	2	A	3-4	90-110	1,4,7	
MENFRO	2	C			8	
MEXICO	4	B			5	a
MIDCO	1	D			4,8	d
MINDEN	2	B	3-4	90-110	7	
MINNITH	3	C			8	
MODALE	4	B			1,3,4,6	a
MONITEAU	3	A	3-4	70-90	1,4,7	
MOVILLE	4	B			1,3,5	a
MULDROW	4	B			1,5	a
MYRICK	2	A	3-4	90-110	1,4,7	
NAMEOKI	4	B			1,4,5	
NAPIER	2	C			8	

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NEEDLEYE	4	C			10	e
NEVIN	2	B	3-4	90-110	1,7	
NEWTONIA	2	C			8	
NICHOLSON	4	C			10	e
NODAWAY	2	C			4,8	
NOLIN	2	C			4,8	
OLMITZ	2	C			2	
ONAWA	4	A	3-4	120-150	1,3,4,9	a
OSAGE	4	A			1,4,5	a
OSKA	4	C			8	c
OTTER	2	A	3-4	90-110	1,4,7	
PARKVILLE	4	B	3-4	120-150	1,3,4,9	a
PARSONS	4	B			1,6	a
PEMBROKE	2	C			8	
PERCIVAL	4	B	3-4	280-300	1,3,4,9	a,d
PERIDGE	2	C			8	
PERSHING	4	B			8	a
PIOPOLIS	4	A			1,4,5	a
PLATO	4	C			10	e
POLO	3	C			8	
POPE	1	C			4,8	
PUTNAM	4	A			1,5	a
QUARLES	4	A			1,4,6	a
RACOON	4	A			1,4,6	a
RADFORD	2	B	3-4	90-110	1,4,7	
RADLEY	2	C			4,8	
RAY	2	C			4,8	
RAZORT	2	C			4,8	
ROSELAND	2	C			8	c
ROSS	3	C			4,8	
SALIX	2	C			3,8	
SAMPSEL	4	A			2	a
SARPY	1	D			4,8	d

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SEYMOUR	4	B			5	a
SHARON	2	C			4,8	
SHARPSBURG	3	C			8	
SUMMIT	4	C			6	a
TINA	4	B			4,6	a
TWOMILE	3	A			1,6	
UNION	4	C			10	e
URICH	3	A	3-4	90-110	1,4,7	
VERDIGRIS	2	C			4,8	
VESSEY	2	B	3-4	90-110	1,4,7	
VIGAR	3	C			6	
VIRATON	4	C			10	e
WABASH	4	A			1,4,5	a
WAKELAND	2	B	3-4	90-110	1,4,7	
WALDRON	4	B			1,4,6	
WEINGARTEN	2	C			8	
WELLER	4	C			6	a
WESTERVILLE	2	B	3-4	90-110	1,4,7	
WILBUR	2	C	3-4	90-110	4,7	
WILDERNESS	4	C			10	e
WINFIELD	2	C			8	
WIOTA	2	C			8	
WOODSON	4	B			1,5	a
ZAAR	4	B			6	a
ZOOK	4	A			1,4,6	a

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MO-14-26a
(The following soils exist in LRA 131 only)

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ADLER	2	C	3-4	90-110	4,7	
ALLEMANDS	4	A			1,3,4,6	a
ALLIGATOR	4	A			1,4,5	a
AMAGON	4	A			1,4,5	a
ASKEW	2	C			8	
BALDWIN	4	A			1,5	a
BEULAH	1	D			8	d
BOSKET	2	C			8	
BOWDRE	4	B	3-4	120-150	1,4,9	d
BRANDON	2	C			8	
BROSELEY	1	D			8	d
BRUNO	1	D			4,8	d
CAIRO	4	A			1,4,5	a,d
CALHOUN	4	A			1,4,6	a
CANALOU	1	C			8	
CARUTHERSVILLE	2	C	3-4	140-180	4,7	
CLANA	1	C			8	d
COLLINS	2	C	3-4	90-110	4,7	
COMMERCE	3	B	3-4	70-90	1,4,7	
CONVENT	2	B	3-4	80-100	1,4,7	
COOTER	2	C			4,8	d
CREVASSE	1	D			4,8	d
CROWLEY	4	B			1,3,5	a
DIEHLSTADT	1	B			4,8	d
DUBBS	1	C			8	
DUNDEE	3	B	3-4	80-100	1,4,7	
FALAYA	2	B	3-4	80-100	1,4,7	
FARRENBURG	2	C	3-4	140-160	7	
FOLEY	4	A			1,4,5	a,b
FORESTDALE	4	A			1,4,5	a
FOUNTAIN	3	A			1,6	
GIDEON	3	A			1,4,6	

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- a. A clayey subsoil layer with slow or very slow permeability restricts the downward movement of water within the root zone of most plants.
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- c. Bedrock within the top 48 inches of the soil profile may interfere with grade and alignment of subsurface drains or conduits.
- d. Subsoil may contain sand. Unstable trenches may occur during installation of conduits. Perforated drains may need filters. If sand is shallow in soil profile, it may limit depth of cut during landgrading.
- e. Fragipan in top 30 inches of profile will limit root development of most crops.

MO-14-26c
(The following soils exist in LRA 131 only)

Soil Name	Soil* Perm.	Natural* Drainage	Subsurface Depth	Drainage Spacing	Recommen-dations*	Soil* Limits
HAYTI	4	A	3-4	80-100	1,4,7	a
JACKPORT	4	A			1,5	a
LAFE	4	B			1,5	a,b
LILBOURN	2	B	3-4	240-300	1,7	
LORING	4	C			10	e
MALDEN	1	D			8	d
MEMPHIS	2	C			8	
MHOON	4	A			1,4,5	a
PORTAGEVILLE	4	A			1,4,5	a
REELFOOT	2	B	3-4	90-110	1,7	
ROELLEN	4	A			1,4,6	a
SAFFELL	2	C			8	
SCOTCO	1	D			8	d
SHARKEY	4	A			1,4,5	a
SIKESTON	3	A	3-4	120-150	1,4,7	
SILVERDALE	1	C			8	
STEELE	4	C	3-4	90-110	7	
TIPTONVILLE	2	C			8	
TOWASAHGHY	2	C			8	d
TUCKERMAN	3	A			1,6	
TUNICA	4	A			1,4,5	a
WARDELL	4	A			1,6	
WAVERLY	2	A	3-4	90-110	1,4,7	
ZACHARY	4	A			1,4,6	a

*See opposite page for description.



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April 4, 2001

ENGINEERING FIELD HANDBOOK NOTICE MO-28

This notice includes Appendix A to Chapter 14 - "Drainage" of the Engineering Field Handbook, National Engineering Handbook Part 650. This appendix contains allowable earthfill loading for various types of pipe - plastic, welded steel, and corrugated steel. Estimates are based on computations made with NRCS Technical Release 77 - Design and Installation of Flexible Conduits - Plastic Pipe. For flexible corrugated plastic tubing installed with a trencher, the earthfill loadings have been adjusted to reflect the trench condition. This appendix is referenced in the revised Conservation Practice Standard 606 Subsurface Drain and Conservation Practice Standard 620 Underground Outlet, Section IV, Missouri Field Office Technical Guide.

These tables do not cover all plastic pipe materials but the more commonly used types. If you have a situation where further analysis is needed, contact your Area Engineer who has a copy of Technical Release 77.

Remove Pages

Insert Pages

MO-14-27 thru MO-14-33,
dated February, 2001

If you have any questions, contact Richard Koenig, Head, Design Section on the Engineering Staff.

A handwritten signature in black ink, appearing to read "Keith E. Admire".

KEITH E. ADMIRE, P.E.
State Conservation Engineer

Attachment

All Engineers
All Area Offices
All Field Offices including S&WCD Offices
All EFH Holders
Midwest Region States

Appendix A

Allowable Earthfill Cover for Various Types of Installation and Pipe Materials

This appendix shows allowable earthfill loading (in feet) above the top of various types of pipe used in low head structures, wetlands, animal waste structures, underground outlets, subsurface drains, etc. This data was computed with Technical Release -77 - "Design and Installation of Flexible Conduits - Plastic Pipe". It was assumed that earthfill loading would not exceed 15 feet. If actual height of soil cover exceeds 15 feet, check design by TR-77 or by prior approved charts, such as shown in Conservation Practice Standard (378) Pond. Maximum allowable deflection in plastic pipe material is 7 1/2 percent.

GENERAL NOTES -- APPLICABLE TO ALL TABLES

Minimum depth of cover is based on crossing with heavy loads such as a modern combine, loaded scraper, or hard tamping with the bucket of a backhoe. For installations where the conduit will not be subject to heavy loads the minimum depth of cover may be reduced, as shown below, except it shall not be less than 2 feet for plastic pipe or 1 foot for metal pipe. Any deviation from these parameters must be approved by the State Conservation Engineer. This minimum depth does not apply to outlet of system where conduit is not subject to loads by equipment travel.

Most references such as Plastic Pipe Association and American Society of Testing and Materials Standard D2321-00 "Practice for Underground Installation of Flexible Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications" recommend a minimum of 3 feet of soil cover when crossing with heavy equipment for soil backfill and two (2) feet for sand backfill. When selecting minimum cover, consider factors such as a combine cutting ruts in a wet field, thus reducing the effective cover.

Single axle trucks with gross weight of 9,000 pounds or less and farm tractors (100 hp or less) ***multiply minimum depth by 0.6***.

Single axle trucks with gross weight of 9,000 to 12,000 pounds and farm tractors (101-150 hp) ***multiply minimum depth by 0.7***.

Single axle trucks with gross weight of 12,000 to 20,000 pounds, (tandem axle trucks with gross weight of 30,000 pounds or less) and farm tractors (over 150 hp) ***multiply minimum depth by 0.8***.

GENERAL NOTES -- APPLICABLE TO ALL TABLES (continued)

When maximum and minimum soil covers are exceeded for various pipes, sand bedding may be used to increase strength of pipe. At terraces six inches of sand backfill all around the pipe may be used to increase strength and prevent piping failures.

In column 2 of tables 1 thru 5 and column 1 of table 6, soil backfill is assumed to be less than 85% Standard Proctor and is labeled "Cover for backfill at less than 85% Standard Proctor"^{a/}. This would include installations where backfill is reasonably good but is not the most desirable. Modulus of soil reaction used is 300.

In column 3 of tables 1 thru 5 and column 2 of table 6, soil backfill is assumed to be according to specifications and have a density that approaches 85% Standard Proctor. This is labeled "Cover for backfill at 85% Standard Proctor" in the following tables. Modulus of soil reaction used is 400.

In column 4 of tables 1 thru 5 and column 3 of table 6, soil backfill is assumed to be according to specifications and has a density that approaches 90% Standard Proctor. This is labeled "Cover for backfill at 90% Standard Proctor". Modulus of soil reaction used is 700.

In column 5 of tables 1 thru 5 and column 4 of table 6, sand backfill is where relatively clean sand is placed a minimum of 6 inches thick all around the conduit. Any sand when dry that will flow when poured out of a bucket is considered relatively clean. Modulus of soil reaction used is 1,000. This soil parameter may also be used if the soil backfill is compacted to 95% Standard Proctor.

In column 6 of Tables 3 and 4, the flexible corrugated polyethylene tubing or corrugated polyvinyl chloride tubing is installed with a trenching machine. Modulus of soil reaction used is 300. Installation deflection used is "4 percent". Installations using backhoes that groove the bottom of the trench to fit the tubing may use this column. Soil loads were reduced for the trench condition.

^{a/} Proctor [curve] (compaction curve or moisture-density curve) is a mathematical curve showing the relationship between the dry unit weight (density) and the water content of a soil for a given compactive effort.

Table 1

Allowable Earthfill Cover (in feet) for
Smooth Polyvinyl Chloride (PVC) Pipe conforming to ASTM^a D1785, D2241, D3034 or AWWA^b C900

SDR ^c	Cover for soil backfill at less than 85% Standard Proctor		Cover for soil backfill at 85% Standard Proctor		Cover for soil backfill at 90% Standard Proctor		Cover for sand backfill or for soil backfill at 95% Standard Proctor	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
41	4.5	4.0	6.5	4.0	11.5	2.8	15.0	2.0
35	6.0	4.0	9.0	2.8	15.0	2.3	15.0	2.0
32.5	7.0	2.8	10.0	2.7	15.0	2.2	15.0	2.0
26	12.5	2.0	14.0	2.0	15.0	2.0	15.0	2.0
21	15.0	2.0	15.0	2.0	15.0	2.0	15.0	2.0

^a ASTM - American Society of Testing and Materials

^b AWWA - American Water Works Association

^c SDR - Standard Dimension Ratio = outside diameter of pipe
pipe wall thickness

Some pipe materials are marked "DR" - Dimension Ratio. This may be used as an equivalent to SDR.

Schedule 40 smooth PVC Pipe is equivalent to SDR 26 as shown in Table 1 for pipe sizes 8 inches and less. For pipe sizes 10 and 12 inches, Schedule 40 pipe is equivalent to SDR 32.5.

Table 2

Allowable Earthfill Cover (in feet) for Smooth Polyethylene (PE) Pipe conforming to ASTM D2239, D3035, and F714

SDR	Cover for soil backfill at less than 85% Standard Proctor				Cover for soil backfill at 85% Standard Proctor				Cover for soil backfill at 90% Standard Proctor				Cover for sand backfill or soil backfill at 95% Standard Proctor			
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
21	6.5	3.7	10.0	2.8	15.0	2.3	15.0	2.0	15.0	15.0	15.0	2.0	15.0	2.0	15.0	2.0
17	9.0	2.9	12.2	2.4	15.0	2.0	15.0	2.0	15.0	15.0	15.0	2.0	15.0	2.0	15.0	2.0
15.5	13.0	2.3	15.0	2.0	15.0	2.0	15.0	2.0	15.0	15.0	15.0	2.0	15.0	2.0	15.0	2.0
13.5	15.0	2.0	15.0	2.0	15.0	2.0	15.0	2.0	15.0	15.0	15.0	2.0	15.0	2.0	15.0	2.0
11	15.0	2.0	15.0	2.0	15.0	2.0	15.0	2.0	15.0	15.0	15.0	2.0	15.0	2.0	15.0	2.0

Table 3

Allowable Earthfill Cover (in feet) for
Corrugated PE Tubing (Heavy Duty) conforming to ASTM F405, F667, or AASHTO^{a/} M252, M294.
Minimum Pipe Stiffness = 30 pounds per square inch^{b/}

Equivalent SDR ^{c/}	Cover for soil backfill at less than 85% Standard Proctor		Cover for soil backfill at 85% Standard Proctor		Cover for soil backfill at 90% Standard Proctor		Cover for sand backfill or soil backfill at 95% Standard Proctor		Cover for tubing installed with trenching machine or backhoe with a grooving attachment	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
25.5	4.0	3.5	5.0	4.0	11.0	2.8	15.0	2.3	9.0	4.0

^{a/} AASHTO - American Association of State Highway and Transportation Officials

^{b/} Obtain pipe stiffness rating from manufacturer's literature or from the appropriate ASTM or AASHTO specifications

$$\text{Equivalent SDR} = (4.47 E_o / PS_o)^{1/3} - 1$$

where

E_o = Initial Modulus of Elasticity

$E_o = 120,000 \text{ psi}$ for class C, Grade P33 or P34 Polyethylene

PS_o = Initial Pipe Stiffness (pounds per square inch)

^{c/} If tubing is installed with a trenching machine or backhoe and the trench is less than 25 inches wide, the minimum cover may be reduced to 3.0 feet if all equipment that would exert a large wheel load crosses the trench perpendicular to axis of tubing. If backhoe is used, the trench bottom shall be grooved to fit tubing. As approved by Area Engineer, the minimum cover may be reduced to 2 feet in terrace channel adjacent to inlets for underground outlets or at outlet of system where tubing is not exposed to wheel loads by equipment travel.

Table 4

Allowable Earthfill Cover (in feet) for
Corrugated PVC Tubing (Heavy Duty) conforming to ASTM F800.
Minimum Pipe Stiffness = 30 pounds per square inch

Equivalent SDR	Cover for soil backfill at less than 85% Standard Proctor		Cover for soil backfill at 85% Standard Proctor		Cover for soil backfill at 90% Standard Proctor		Cover for sand backfill or soil backfill at 95% Standard Proctor		Cover for tubing installed with trenching machine or backhoe with groove attachment	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
36.6	4.5	4.0	6.0	4.0	11.5	2.8	15.0	2.3	9.0	4.0 ^{a/}

^{a/} If tubing is installed with a tiling machine or backhoe and the trench is less than 25 inches wide, the minimum cover may be reduced to 3.0 feet if all farming equipment that would exert a large wheel load crosses the trench perpendicular to axis of tubing. If backhoe is used, the trench bottom shall be grooved to fit tubing. As approved by Area Engineer, the minimum cover may be reduced to 2 feet in terrace channel adjacent to inlets for underground outlets or at outlet of system where tubing is not exposed to wheel loads by equipment travel.

Table 5a

Equivalent Standard Dimension Ratio (SDR) for
Corrugated Polyethylene Tubing with smooth interior

Nominal Pipe Diameter (inches)	Pipe Stiffness PS ₀ (pounds per square inch)	Equivalent SDR
4	50	23.0
6	50	23.0
8	50	23.0
10	50	23.0
12	45	23.8
15	42	24.4
18	40	24.8
24	34	26.1
30	28	27.7
36	22	30.0
12 - 24	50	23.0

Table 5b

Allowable Earthfill Cover (in feet) for
Corrugated Polyethylene Tubing with smooth interior

Pipe Size (inches)	Equivalent SDR	Cover for soil backfill at less than 85% Standard Proctor		Cover for soil backfill at 85% Standard Proctor		Cover for soil backfill at 90% Standard Proctor		Cover for sand backfill or soil backfill at 95% Standard Proctor	
		Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
4 - 10	23.0	7.0	3.5	10.0	2.8	15.0	2.3	15.0	2.0
12	23.8	6.6	3.6	9.5	2.9	15.0	2.3	15.0	2.0
15	24.4	6.4	3.7	9.5	2.9	15.0	2.3	15.0	2.0
18	24.8	6.2	3.8	9.4	2.9	15.0	2.3	15.0	2.0
24	26.1	5.0	4.0	9.0	2.9	15.0	2.3	15.0	2.2
30	27.7	5.0	4.0	6.2	3.8	13.0	2.4	15.0	2.2
36	30.0	NOT ACCEPTABLE	NOT ACCEPTABLE	5.6	4.0	11.0	2.5	15.0	2.2
12 - 24	23.0	7.0	3.5	10.0	2.8	15.0	2.3	15.0	2.0

Table 6

Allowable Earthfill Cover (in feet) for
Smooth Steel Pipe with 3/16" minimum wall thickness or 16 gauge Corrugated Galvanized or Aluminum Metal Pipe

Cover for soil backfill at less than 85% Standard Proctor	Cover for soil backfill at 85% Standard Proctor			Cover for soil backfill at 90% Standard Proctor			Cover for soil material with sand backfill or soil backfill at 95% Standard Proctor		
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
15.0	1.0	15.0	1.0	15.0	1.0	1.0	15.0	1.0	1.0